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ABSTRACT

Asserting that toxic chemicals can be found throughout school grounds in pesticides, building materials, school supplies, cleaning products, office equipment, and personal care products, this reports details the prevalence of toxic chemicals within schools and recommends methods for reducing exposure. Following an executive summary, the report address indoor air quality in U.S. schools, sources of toxic chemical pollution, Vermont case studies, and state-level and individual school recommendations. (Contains 35 references.) (EV)

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Toxic Chemical Exposure in Schools:

Our Children At Risk

Vermont Public Interest Research Group

March, 1998

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Toxic Chemical Exposure in Schools:

Our Children At Risk

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Vermont Public Interest Research Group
March, 1998

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About Vermont Public Interest Research Group and Vermont Public Interest Research and Education Fund

As Vermont's largest citizen-based advocacy organization, VPIRG is protecting consumer interests, preserving Vermont's environment, and keeping our government accountable. VPIRG combines public education, grassroots organizing, legislative lobbying and research efforts toward meeting these goals. VPIRG was founded in 1972 and has since grown to include 20,000 members across the state. The Vermont Public Interest Research and Education Fund is the research and education arm of VPIRG.

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EXECUTIVE SUMMARY

Each day, students, teachers and staff are exposed to toxic chemicals in schools. Pollutants such as benzene, lead, formaldehyde and arsenic are found in materials commonly used in classrooms, cafeterias and playing fields.

Children in particular are at risk from exposure to toxic chemicals because their bodies are undergoing rapid growth and development and are likely to be in contact with these chemicals while at play. Children consume three times as much air per pound of body weight as an adult, drink three times as much water and eat three times as much food and thus are more susceptible to the effects of toxic chemicals.

Dangerous levels of exposure to toxic chemicals occur throughout our chemically dependent society, however this crisis is perhaps most alarming in our schools. Air quality problems surfaced in the 1970s when schools began reducing fresh air in ventilation systems in an effort to lower energy costs. These "tight buildings" trap pollutants which may be released from items containing toxic chemicals. Compounding the problem, Vermont's long winters keep students inside schools most of the day, away from fresh air. Toxic chemicals are found in products used throughout school grounds including pesticides, building materials, school supplies, maintenance products and office equipment. Chemicals from these products may remain in the air or settle onto desks, carpets, floors and other areas which can become a source of human exposure.

Toxic chemicals may enter the body through inhalation, ingestion or absorption through the skin. Most chemicals in use today have not been tested for human toxicity. For those chemicals which have been tested, most assumptions about human toxicity are based on adult exposure, rather than on exposures to children who can be expected to be more sensitive. Exposure to toxic chemicals in youth can cause irreversible damage.

Sources of toxic chemical exposure in schools include:

- **Pesticides.** Most U.S. schools apply pesticides in and around their buildings whether or not there is a pest problem. Shortly after application, the chemical compounds of the pesticide become airborne, settling on grass, carpets, desks, tables and toys. Once airborne particulate settles, residue may remain for several days or longer.
- **Building Materials.** Many building materials such as adhesives, pressed-wood products, paints and vinyl-coated wallpaper contain toxic chemicals. There are no guidelines for using non-toxic construction materials, which makes it difficult to protect occupants from the hazards of remodeling. Carpeting alone may release over 120 different toxic chemicals.
- **Art and Science Classes.** Many of the materials used in these classes contain toxic chemicals including oxidizing materials, dyes, metal pigments and solvents.
- **Industrial and Metal Shop.** Many activities in these classes may release toxics into the air including machining, casting and welding. Though exposure levels in shop can be similar to levels found in industrial settings, there are no air quality guidelines for these activities in schools.
- **Cleaning Products.** Many cleaning products containing toxics are commonly used in and around schools including ammonia-based cleaners, disinfectants, furniture polish and

window cleaners. There is usually little effort to substitute non-toxic alternatives for these hazardous materials

- **Office Equipment and Supplies** A school's office equipment and supplies such as photocopier toner and typewriter correction fluid may emit toxic gases. Computers and printers are also known to emit toxic pollutants.

Compounding the problem is a lack of regulatory standards for toxic chemicals. The U.S. Environmental Protection Agency's (EPA) National Ambient Air Quality Standards regulates only six outdoor air pollutants and again, those regulations are designed to protect adults. Other governmental agencies, such as the Occupational Safety and Health Administration, have set guidelines for air pollutants in workplace which may not be applicable to children. Currently there are no standards for indoor air contaminants for schools.

Vermont has already felt the effects of poor indoor air quality in our schools. There are numerous examples of "sick schools" throughout the state where students and staff become sick from exposure to toxics.

- After two employees of North Country Union High School (NCUHS) were diagnosed with multiple chemical sensitivity, the school commissioned air quality tests. These tests revealed unsafe levels of highly toxic chemicals such as benzene and toluene. Part of the problem was traced to NCUHS' inadequately maintained ventilation system. In addition to upgrading the school's ventilation system, a Citizen's Committee on Indoor Air Quality has recommended the school purchase less toxic supplies.
- At U-32 Junior and Senior High School, both students and complained of headaches, eye irritation and respiratory irritation while the school was under renovation. Air tests revealed the presence of nine volatile organic compounds and staff members detailed ten incidents of toxics in the ventilation system. However, to date the school is still experiencing indoor air quality problems and is in violation of building safety codes.
- When the staff at Blue Mountain Union School were surveyed for symptoms attributable to indoor air quality, 90% reported experiencing adverse health affects. Air tests found the school's air to be "seriously polluted." The school followed the recommendations of an air quality consultant and discontinued the use of toxic cleaners, removed carpet from various locations and improved the ventilation system. Since these measures were implemented, there have been no reports of indoor air quality problems.

Summary of Recommendations

- ✓ A State Safe Materials Policy to reduce the use of toxics in schools. This policy should provide a set of criteria governing the selection of materials and products used in schools;
- ✓ Adoption and enforcement of ventilation standards for all Vermont schools;
- ✓ Identifying non-toxic alternatives and coordinated purchasing of non-toxic school supplies and building materials. The Department of Education should develop information on non-toxic products as well as assist local school districts by coordinating group purchasing to reduce costs;

- ✓ Appointment of an Environmental Health Coordinator by each school to monitor concerns and facilitate communication about indoor air quality and environmental health issues in the school;
- ✓ Completion of a toxics and air quality audit for each school to evaluate building design and ventilation systems and to identify potential sources of environmental pollution in the school;
- ✓ An immediate reduction in the use of toxics. All schools can take steps to reduce the use of toxics at little or no cost by substituting non-toxic alternatives for products containing toxic chemicals; and
- ✓ Upgrading and maintaining ventilation systems to ensure that they are functioning properly.

Tools for Schools

The Environmental Protection Agency's Tools for Schools program is a great way to help schools begin evaluating and monitoring indoor air quality The kit provides the basic information parents and teachers need to understand and identify air quality problems. It is easy to use and shows schools how to resolve and prevent indoor air problems at little or no cost. Included in Tools for Schools is an indoor air quality problems solving wheel to help identify the sources of problems and basic air quality checklists to help the schools staff and administration identify, evaluate and recognize sources of indoor air quality problems.

To find out more about Tools for Schools and how to use it, contact VPIRG at (802) 223-5221.

INTRODUCTION

Toxic chemicals can be found throughout school grounds in pesticides, building materials, school supplies, cleaning products, office equipment and personal care products. This report details the prevalence of toxic chemicals within schools and recommends methods for reducing exposure.

Toxic Chemicals in the Environment

Our air, water, buildings, and food are filled with synthetic and natural chemicals which may contribute to increased rates of cancer, birth defects and reproductive and nervous system disorders. There are over 70,000 chemicals in commercial use with 2,000 new ones entering the market each year.[1] Unfortunately, little is known about the health effects of these chemicals; there is complete toxicity data available for only 296 of them.[2] Further, according to the National Academy of Sciences only 2% of doctors in the United States are qualified to diagnose toxic chemical exposure and related illnesses.[3]

Exposure to toxic chemicals has been linked to Multiple Chemical Sensitivity (MCS), which can be experienced as a wide range of physical and mental symptoms. MCS can be triggered by exposure to a variety of chemicals including pesticide residues, household cleaners, glues and emissions from carbonless copypaper. Both acute (short-term) and chronic (long-term) health problems have been linked to MCS. Acute effects tend to manifest as soon as the sufferer enters a building and worsen throughout the day. Most of those affected find relief of symptoms one to four hours after leaving the building in question. Short-term symptoms include depression, moodiness, headaches, fatigue, inattentiveness, dizziness, memory loss, nervousness, eye, throat and skin irritation and reduced attention span. These symptoms generally persist through the duration of time the individual is exposed to the toxic chemical. Possible chronic effects of exposure to toxic chemicals include cancer, brain damage, respiratory disease, asthma and immune, nervous and reproductive system damage.

Toxics Pose Increased Risk to Children

Children are more susceptible to toxic chemical poisoning than adults because their bodies are still growing and developing. Their play habits and school activities greatly increase their chance of exposure to toxics.[4] A child's normal growth pattern can be altered and/or the growth of unwanted cells can be stimulated by exposure to chemicals. During school age years the nervous, immune, reproductive and respiratory systems are all undergoing significant changes.[5]

- In the nervous system, connections between regions of the brain which affect the ability to learn and behavior patterns are formed in these years.
- Some airborne toxics attach themselves to membranes in the respiratory tract. Constant exposure to toxic chemicals in youth can lead to diminished lung capacity and function, accelerated aging of the lungs, higher rates of chronic lung disease (bronchitis and emphysema) and lung cancer.
- If the immature immune systems of children are subjected to years-long exposure to toxics, one result may be a lifetime of suppressed immune responses.

- Children receive higher "doses" of toxic chemicals than adults do. While children have the same exposure through food, water and air, they have fewer pounds of body weight with which to process the pollutants they ingest. A child's metabolic system is also unable to break down and excrete many toxic substances, increasing the likelihood of immune impairment, neurological problems and cancer.[6] Children are more inclined to engage in hand-to-mouth activity, lie on carpets or roll in the grass, increasing their chance of being exposed to toxic chemicals. Children are curious and may explore the school grounds which can place them in contact with toxic chemicals.[7]

INDOOR AIR QUALITY IN U.S. SCHOOLS

Structural Design of School Buildings

As a result of the 1973 oil embargo and ensuing energy crisis, many school districts placed a premium on energy efficiency. Unfortunately, this mandate was often a narrow one and many structural "efficiencies" in new construction saved heating and cooling costs by sacrificing fresh outside air used in ventilation systems. Older schools were made "tight" to reduce energy costs by sealing windows and running ventilation systems at lower settings. Further, in older schools high concentrations of toxic chemicals may have built up in carpets, drapes, shelves and other furnishings. While energy efficient, these tight buildings can trap toxics and circulate them through the building.[8]

Indoor Air Quality Problems in the United States

As Americans spend 90% of their time indoors, the U.S. Environmental Protection Agency (EPA) ranks indoor air pollution as one of the top five environmental health risks to the public.[9] In 1995, the U.S. General Accounting Office (GAO) reported 20% of U.S. schools had poor indoor air quality and over 25% had inadequate ventilation. The breakdown by region of schools reporting poor indoor air quality is shown in Table 1.

Table 1: Regional Breakdown of Schools Reporting Inadequate Indoor Air Quality

Region	Percent Of Schools Reporting Poor Indoor Air Quality
Northeast	19.9%
Midwest	18.4%
South	16.8%
West	23.5%

Indoor air quality has been linked to an increase in environmental illness among children. Cases of asthma linked to indoor air pollution and ingestion of toxic chemicals have increased by more than one third in the past fifteen years, affecting 4.2 million children under the age of 18.[10] According to the American Lung Association, asthma is the most common cause of school absenteeism.[11]

Air Quality a Problem for Many Vermont Schools

Vermont schools are also experiencing significant indoor air quality problems. A 1995 GAO survey found over 25% of the responding Vermont schools have poor indoor air quality and over 32% have inadequate ventilation systems. In 1993, U.S. Representative Berme Sanders' Vermont School Air Quality Survey found 30 of the 60 responding schools reported indoor air quality problems.

The results of the Vermont School Air Quality Survey reveal some common problems in many schools:

- Cabot School reported health problems due to inadequate amounts of fresh air in the building. The school superintendent said that solving the problem requires modifying the current ventilation system but, "it has been so jerryrigged since the energy conservation days that substantial and expensive work will have to be done. In addition, reintroducing fresh air will cause (the school's) energy costs to increase."
- Teachers and staff at Alburg Elementary reported headaches, upper-respiratory problems, sinus infections, allergies, sore throats and itchy eyes due to poor ventilation. According to the staff member filling out the survey, "the health problems ...seem to clear up or improve immensely during vacations. Everyone seems to come back after vacations in relatively good health. Then by the time the next vacation is due, people are coughing, sniffling, etc. again."
- Staff- at Hartland Elementary reported repeated headaches, nausea and dizziness. Upon inspection of the school, it was discovered that sewer gas was being drawn into the building due to inadequate construction of ventilation stacks.
- Cambridge Elementary reported students and teachers were experiencing sinus infections, headaches, respiratory difficulty, watery eyes, bloody noses and sore throats due to poor ventilation.
- Several students and teachers reported breathing problems and headaches at the Rutland Town School due to reported poor ventilation in the industrial shop where toxic chemicals were being used.
- Staff' and students at Champlain Valley Union High in Hinesburg reported breathing problems and upper respiratory infections while in the science lab the computer lab, and the music room. According to the school nurse, the major problem at the school is that the "building has been remodeled so many times over the years" without thought to proper ventilation.

Table 2 provides a brief account of other cases of toxic chemical exposure in Vermont schools. Undoubtedly, many other schools in Vermont are currently experiencing air quality problems, but for a variety of reasons, official complaints have not been filed. The episodes listed below only represent symptoms of acute exposure. The long-term effects of continued low-level exposure are much harder to quantify.

Table 2: Vermont Schools Reporting Toxic Chemical Exposures

School and Town	# of Effected Individuals and the Reported Health Effects	Known or Suspected Cause
Mount Anthony Union Middle School, Bennington[12]	Several teachers experienced headaches, eye irritation and sinus problems while at school.	The ventilation system is believed to be the cause of the symptoms. However, the system was replaced and the teachers are still experiencing adverse health effects.
Country Corner Day Care Center, North Bennington[13]	Six workers experienced nausea, severe headaches and dizziness.	A chemical defoliant was sprayed around the outer area of the property.
Wallingford Elementary School, Wallingford[14]	One teacher and several students experienced respiratory problems.	Newly installed carpet in a temporary classroom.
Allen Brook Elementary School, Williston[15]	. Several students and teachers experienced sore throats, irritated eyes and other symptoms.	Toxic sealant on the gymnasium floor.
Otter Valley Union High School, Brandon[16]	Five students and dozens of teachers experienced dizziness, fainting, shortness of breath, nausea, chest pains, headaches and fatigue.	High levels of carbon dioxide, old carpeting, inadequate ventilation system and the presence of volatile chemicals.
Shelburne Community School, Shelburne[17]	67 people reported itchy eyes and flushed skin.	The school was unable to figure out the cause of the symptoms. The school remained closed until the health department rendered it safe.
Rutland Town School, Rutland[18]	Five teachers have developed differing forms of cancer within the same time period.	Unknown

Source: *Vermont School Air Quality Survey, 1993*, Office of U.S. Representative Bernie Sanders

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SOURCES OF TOXIC CHEMICAL POLLUTION

The complete list of all possible sources of toxic chemicals is constantly being expanded as knowledge of toxic illness increases. However, it is known that people have become sick when exposed to toxic chemicals from several sources such as pesticides, building materials, school supplies, cleaning supplies and office equipment.

Pesticides

Pesticides are chemicals used to control insects, unwanted plants, fungi and rodents. There are over 1,500 pesticides in use in the U.S., many of which are blended to produce over 50,000 commercial pesticide products. Only 10% of these products have been evaluated for health effects.[19]

Most U.S. schools apply pesticides in and around their buildings. Schools typically contract with professionals to spray classrooms, cafeterias, kitchens and playgrounds monthly, whether or not there is a pest problem. Though most schools spray after school hours or on weekends, contaminants may remain in the air and the ground several days after application. In 1991, the American Association of Poison Control Centers' National Data Collection System received over 83,000 reports of pesticide exposure, 67°/u of which were from children under 18.[20]

A Massachusetts Public Interest Research Group survey of eighteen school districts found over 80% of responding schools use pesticides and the majority do not notify parents or students of the dates spraying occurs. The New York State Board of Regents Advisory Committee on Environmental Quality of Schools surveyed 331 schools to determine if pesticides were in use and whether any precautions were taken to reduce exposure. Eighty-seven percent of schools responding use pesticides and less than 10% of those notified parents and students prior to applications.[21]

Commercial pesticides are composed of both active and inert ingredients. Active ingredients are the chemicals used to kill the target pest and must be listed in a warning on the product's label. Inert ingredients-which form the solution, dust, or granule containing the active ingredient-typically include benzene, toluene or xylene and constitute at least half of the product's volume. These toxic chemicals are not required to be individually listed on the warning label. Table 3 provides a list of common types of pesticides and some of their health effects.

Table 3. Common Pesticides and Their Health Effects

Type of Pesticide	Pesticide Use	Toxic Chemical Contaminants	Known Health Effects of the Pesticide
Insecticides	Chemicals designed to kill insects.	Acephate, Aldrin, Aspon, Baygon Bendiocarb, Boric Acid, Carbaryl, Chlordane, Chlorpyrifos, Diazinon Dichlorovos, Dicofol, Heptachlor, Lindane, Malathion, Methoxychlor, Parathion, Phorate Piperonyl Butoxide, Safrotin, Sulfuryl Flouride, Trichlorofon and Toxaphene.	Headaches, nausea, rashes aching joints, disorientation and various forms of cancer.
Fungicides	Chemicals designed to kill molds and fungus.	Benomyl, Captan, Chlorthalonil, and Maneb.	Headaches, nausea, rashes, aching joints, disorientation, various forms of cancer.
Herbicides	Chemicals designed to kill unwanted weeds and plants.	Alachlor, Atrazine, Benefln, Betasan, Bromacil, Dacthal, Dicamba, Dichloran, Diquat dibromide, Diuron, Endothall, Ferric sulfate, Glyphosate, Metolachlor, Prometon, Sodium Metaborate, Simazine and Tebuthiuron.	Headaches, nausea, rashes, aching joints, disorientation, various forms of cancer, soft tissue sarcoma, and non-Hodgkin's lymphoma.

Source: National Coalition Against the Misuse of Pesticides

Pesticides may be applied both outdoors and indoors along open floor areas, cracks and baseboards. Shortly after application, the chemical compounds of the pesticide become airborne, settling on grass, carpets, desks, tables and toys. Once airborne particulate settles, residue may remain for several days or longer. A study conducted by the Occupational Health Group on chlorpyrifos, a pesticide commonly used in schools, found it will remain in the applied area up to two days and recommended occupants not enter the building for 24 hours after application.[22] It is not uncommon, however, for the application of chlorpyrifos to take place while school is in session or before class begins, without warning to students or teachers.

Table 4. Pesticides Commonly Applied in Schools

Product Name	Type of Pesticide	Sample Target Pests	Known Health Effects
Acephate	Insecticide	Cockroaches and ants.	Headache, flu-like symptoms, cancer, reproductive disruption and irritation to nervous system.
Bendiocarb (Ficam)	Insecticide	Ants, fleas, ticks, cockroaches, silverfish and crickets.	Diarrhea, muscle weakness, dizziness, headache, blurred vision, spasms, sweating and sensory and behavioral disruption.

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Cldorpyrifos	Insecticide	Ants, termites, fleas, cockroaches and mosquitoes.	Headache, nausea, dizziness, abdominal cramps, vision impairment, weight loss, vertigo, convulsions, toxic psychosis, drowsiness, twitching muscles, mental confusion and peripheral neuropathy.
Cypermethin	Insecticide	Ants and cockroaches.	Allergic dermatitis and flu-like symptoms.
2,4-D	Herbicide	Broadleaf weeds	Vomiting, diarrhea, anorexia, ulcers, damage to liver and kidney and nervous system damage.
Dicambra	Herbicide	Broadleaf weeds	Skin irritation, vomiting, coughing, dizziness, sensory and behavioral disruption, spasms and sweating.
MCPP (Mecoprop)	Herbicide	Broadleaf weeds	Skin irritation, vomiting, coughing, dizziness, sensory and behavioral disruption, spasms and sweating.

Source: *Pesticides in Schools: Reducing the Risks*, New York State Board of Regents' Advisory Committee on Environmental Quality of Schools, February, 1996.

Building Materials

Many building materials-including adhesives, caulking compounds, carpeting, pressed-wood products, floor and wall coverings, paints, stains and varnishes, upholstery and vinyl-coated wallpaper-contain toxic chemicals. Remodeled classrooms pose potential health risks to school occupants because many newly-installed building materials and furnishings emit fumes simultaneously. There are few regulatory standards for indoor air contaminants and no guidelines for using non-toxic construction materials, which makes it difficult to protect occupants from the hazards of remodeling. Table 5 (next page) lists some of the most common building materials known to contain toxics.

Adhesive and Caulking Compounds

Large amounts of adhesives are used to secure wall and floor panels. Caulking is used around windows and doors to reduce the amount of outside air entering a room and to prevent water leakage. Typical contaminants emitted from adhesive and caulking compounds include benzene, xylene and toluene.

Carpeting

When a carpet is installed, toxic fumes are released. There are over 120 different toxic chemicals which may be emitted by carpeting, including formaldehyde, which is used as glue in carpet backing.[23] A study conducted by Anderson Laboratories in 1992 found mice exposed to toxic emissions from various carpets sustained neurological problems and soon died from the exposure.[24] Carpets may continue to emit fumes for several months.

Pressed Wood Products

Cabinets, wall sheathing and furniture in schools are frequently made from pressed wood products such as chipboard and particle board. The wood finishing and glue used in these products is made from urea-formaldehyde which may emit toxic fumes for up to five years.[25]

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Urea-formaldehyde has been linked eye, upper respiratory and skin irritation. If these materials are placed in areas of high heat and humidity, off-gassing may occur for the life of the product.

Paints, Stains and Varnishes

Paints, stains and varnishes used in schools may off-gas for weeks after application. Most paints dry through evaporation of solvents. Fumes emitted by paint may affect the occupants of a room if it is not properly vented after application. Although the use of lead in paint is now prohibited, older school buildings may still contain surfaces covered with lead-based paint which is a significant health hazard when ingested.

Table 5: Toxic Building Materials

Sources	Known Toxic Chemical Contaminants	Known Health Effects From Source
Adhesives and Caulking Compounds	Alcohols, Alkanes, Amines, Benzene, Decane, Diethylbenzene, Dimethylbenzene, Ethylbenzene, Formaldehyde, Limonene, Methylethylketone, Nonane, Octane, n-Propylbenzene, Terpene, Toluene and Xylenes.	Headaches, tiredness, eye, nose and throat problems, nausea.
Carpet	Acetaldehyde, Benzaldehyde, Benzene, Butyl Benzyl Phthalate, Carbon Disulfide, Chlorobenzene, Chloroform, 1,2-Dichloroethane, Dimethethylheptanes, 1,4-Dioxane, Ethanol, Ethyl Acetate, Ethylbenzene, Ethylmethylbenzenes, Formaldehyde, Hexanes, Hexenes, Methylcyclopentanol, Methylene Chloride, Octanal, Pentanal, Phenol, 4-Phenylclohexene, Styrene, Tetrachloroethane, 4-Thenylcyclohexene, Toluene, 1,1,1-Trichloroethane, Trichloroethene, Trimethylbenzenes, Undecanes and Xylenes.	Flu-like symptoms, eye, nose, and throat irritation, headaches, rashes, nausea, fatigue, respiratory problems, asthma and multiple chemical sensitivity.
Roofing Materials	Asbestos	Respiratory problems
Pressed Wood Products	Amines, 3-Carene Ethylbenzene Urea-Formaldehyde n-Hexane, Limonene, n-Pentanol, n-Propanol, 2-Propanone, n-Propylbenzene and Terpene.	Irritation of the eyes headaches, nausea, slight memory lapses and upper respiratory irritation.
Drapery	Toluene and Formaldehyde.	Eye, nose and throat irritation, skin rashes, headaches, dizziness, vomiting, nervous system depressant and possible human carcinogen.
Floor and Wall Coverings	Amines, Alkanes, C3-benzene, C4-Benzene, n-Butanol, 2-Butanone, Diethylbenzene, Ethylacetate, Formaldehyde, Isopropylbenzene and Methyl styrene, Xylenes.	Various forms of cancer andrespiratory irritation.

Paints	C4-benzenes, 2-Ethoxyethanol, 2-Ethoxyethylacetate, Isopropylbenzene, Lead, Limonene, n-Propylbenzene and Toluene.	Headache, nausea, dizziness, irritation to respiratory and nervous systems, anemia and injury to the kidneys and reproductive organs.
Stains and Varnishes	Amines, Benzene, Decane, Dodecane, Formaldehyde and n-Heptane	Eye, nose and throat irritation, coughing, skin rashes, headaches, nausea, nervous system depressant and possible human carcinogen.

Source: Bradford O. Brooks & William F. Davis, *Understanding Indoor Air Quality, 1992.*

Curriculum-Based School Supplies

Students may be exposed to toxic materials in art and shop classes and science laboratories. Though some curriculum-based school supplies may be safe if certain precautions are taken, children in kindergarten through sixth grade are more susceptible to harm from these products because they are not as likely to read warning labels on packaging.

Art Supplies

Many solvents, metal pigments, mineral dusts, dyes and preservatives used in art classes are toxic. Though Congress passed the Labeling of Hazardous Art Materials Act requiring toxic art supplies be labeled with a warning of the hazardous contents, this law does not preclude a teacher from purchasing toxic art supplies. Rather, it permits the Consumer Product Safety Commission to sue a school who has purchased art materials with a chronic hazard warning label for use in pre-kindergarten through sixth grade. Children in grades 7-12 are permitted to use hazardous materials. Recent findings indicate there may be toxic chemical exposure from art supplies which are labeled as non-toxic.[26] Table 6 lists the most toxic art supplies and their known health effects.

Table 6: Toxic Art Supplies

Toxic Substance /Materials Children Should Avoid Handling	Art Supply Where Toxic Substance May Be Found	Known Health Effects
Solvents, including acetone, benzene, hexane, heptane, xylene, carbon tetrachloride, toluene and turpentine.	Permanent markers, wood stains, spray fixatives, spray adhesives, rubber cement and silkscreen inks.	Brain and nerve damage, irritation of the eyes, nose and throat, irritation to the nervous system and cancer.
Metal Pigments, including lead, lead chromate, cadmium, manganese, zinc, arsenic, copper and their compounds.	Artist's acrylics, oil paints, silkscreen inks, ceramic glazes, artist's pastels and metal enameling glazes.	Lead may cause brain damage and learning disorders; Cadmium has been linked to prostate cancer, lung cancer and kidney damage; Manganese poisoning has been linked to neurological disorders.

Mineral Dusts, including silica and asbestos.	Earth clays, artist's pastels, instant paper mache and glazes.	Silica in free crystalline form causes respiratory illness; Asbestos has been linked to lung cancer and respiratory problems.
Preservatives, including formaldehyde and pesticides.	Artist's acrylics, poster paints, silk screen inks, mucilage, wheat pastes and plasticine clays.	Formaldehyde can cause eye, nose and throat irritation, coughing, skin rashes, headaches, dizziness, nausea, vomiting, nervous system depressant and is a suspected human carcinogen.

Sources: Common Hazardous Components Of Art Materials, VPIRG, and Toxics in Art Supplies in Washington, DC Area Public Schools, U.S. Public Interest Research Group, April 1986,

Science Laboratories

Science laboratories present significant health risks to children in grades 7-12. Laboratories are home to chemicals that may cause harm if not properly stored and if the room is not properly vented. Common toxic compounds found in a lab include imflammable liquids, oxidizing materials and solvents. Table 7 is a partial list of high-risk chemicals found in school laboratories.

Table 7: Toxic Chemicals in Science Laboratories

Toxic Chemicals	Carcinogens	Corrosives and Reactives
Ammonium Metavanadate	Aniline	Bromine
Brucine Sulfate	Arsenic	Hydrofluoric Acid
Thiourea	Benzene	Osmium compounds
Colchicine	Carbon Tetrachloride	Titanium Tetrachloride
Lead compounds	Chloroform	
Leaking or improperly stored gas cylinders	Formaldehyde	
Mercury and Mercury compounds	Lead Acetate	
Potassium, Silver and Sodium Cyanide		
Sodium Azide		
Thioacetamide		

Source: David Dougan, A Parents Guide to Curriculum-Based Chemicals in Schools - A Perspective, 1993

Industrial and Metal Shop

Many activities in these classes may release toxics into the air including machining, ceramic coating, dry grinding, forming and forging, work with molten metals, oven heating operations, casting and welding[27] Exposure levels in shop can be similar to levels found in industrial settings, yet there are no air quality guidelines for these activities in schools.

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Cleaning Products

Toxic chemicals are used in cleaning agents due to their ability to dissolve substances and evaporate quickly. Typical toxic cleaning products used in and around schools are ammonia-based cleaners, bleach, disinfectants, drain cleaner, floor and furniture polish, scouring powder, rug and upholstery cleaner, toilet cleaners and window cleaners.

The procurement of cleaning products is generally based on the cost and efficacy of a given product. Unfortunately, possible adverse health effects is rarely a factor in the decision to purchase these products or toxic-free substitutes. Table 8 provides a list of toxic ingredients and the known health effects of cleaning products generally used in and around school buildings.

Table 7: Toxic Cleaning Supplies

Type of Cleaning Product	Toxic Chemical Ingredient	Known Health Effects
Ammonia Based Cleaners	Ammonia and Ethanol	An irritant and causes burns.
Floor and Furniture Polish	Diethylene Glycol, Nitrobenzene and Petroleum Distillates	Carcinogenic
Rug and Upholstery	Diethylene Glycol, Napthalene, Oxalic Acid and Perchloroethylene	An irritant and causes burns.
Toilet Cleaner	Calcium Hypochlorite, Muriatic Acid and Oxalic Acid	An irritant and causes burns.
Window Cleaners	Butyl Cellosive, Diethanolamine, Ethyl Cellosive, Ethylene Glycol, Kerosene, Methanol, Monoethanolanune, Naphtha, Propylene Glycol, Stoddard Solvent, Toluene and Xylene	An irritant

Source: *Stepping Lightly on the Earth: A Minimum Impact Guide to the Home*, Greenpeace Action, 1995.

Office Equipment and Supplies

A school's office equipment and supplies may also emit toxic gases. These include carbonless copy paper, photocopier supplies, rubber cement and typewriter correction fluid. Computers, printers and microfiche developers are also known to emit toxic pollutants. Photocopiers, for example, release small quantities of toxic chemicals through their exhaust.[28] Table 8 is a list of office equipment known to emit toxic chemicals into the air.

Table 8: Office Equipment Emitting Toxic Chemicals

Sources	Known Toxic Chemical Contaminants)	Health Effects From Source
Carbonless Copy Paper	Chlorobiphenyl, Cyclohexane, Dibutylphthalate, Formaldehyde and Paratoluene sulfinate.	Mucous membrane irritation, skin rashes, headaches, fatigue and memory loss.

Computers and Video Display Terminals	n-Butanol, 2-Butoxyethanol, Butyl 2-methylpropyl phthalate, Ethylbenzene, 4-Hydroxy Benzaldehyde, 3-Methylene-2-Pentanone, 2-Methylene-2-propenoic Acid, Ozone, Phenol, Toluene and Xylene. Thiourea	Vision impairment, headaches and musculosketal symptoms.
Copy machines	Ethanol, Methanol, Methyl Alcohol, 1,1,1-Trichloroethane and Trichloroethylene.	Dizziness, nausea. vonuting, eye irritation eyes and blurred or temporary loss of vision.
Photocopiers and related supplies	Ammonia, Benzaldehyde, Benzene, Butyl Methacrylate, Carbon Black, Cyclotrisiloxane, Ethylbenzene, Isopropanal, Methylmethacrylate, Nonanal, Ozone, Styrene, Terpene, Toluene, 1,1,1-Trichloroethane, Trichloroethylene, Xylenes and Zinc.	If unventilated, ozone will cause irritation to mucous membranes, headaches and vision impairment.

Source: Bradford Brooks & William Davis, *Understanding Indoor Air Quality*, 1992, Occupational Safety and Health Administration. Ronald Turner, Bruce Lippy, and CIH Aerosol Monitoring and Analysis, Inc., *Guidelines For Controlling Indoor Air Quality Problems Associated With Kilns, Copiers, and Welding In Schools*, Maryland State Department of Education, February, 1991.

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VERMONT CASE STUDIES

The following case studies are examples of indoor air quality problems in Vermont schools.

North Country Union High School

In 1995, two employees of North Country Union High School (NCUHS) were diagnosed with multiple chemical sensitivity, which has been linked to indoor air pollution. They reported an array of symptoms including headaches, nasal congestion, burning eyes, coughing, difficulty breathing, nausea, lethargy and respiratory irritation. Their symptoms tended to dissipate on weekends, school vacations and during summer months.[29]

In response, the school in 1996 commissioned ATC Environmental Inc. and Honeywell Inc. to conduct separate air quality studies on possible pollutant sources and the ventilation system in three rooms. The companies tested air in the library, automotive area and computer aided drafting (CAD) room. ATC found air toxic levels in both the automotive and CAD room substantially exceeded the recommended level. It was also found that carbon dioxide levels ranged from 550 to 2000 parts per million, exceeding the recommended threshold of 1000 parts per million.[30]

The Honeywell report found the school's ventilation system was inadequately maintained. Several of the rooms' ventilators were run at insufficient speeds and were not circulating fresh air. The report concluded that indoor air quality would be adequate if the ventilators were run at least medium speed and outside air dampers remain fully open. The school then hired Anderson Laboratories, an indoor air quality consulting firm, to examine the reports. Anderson Laboratories determined the air in NCUHS posed immediate health concerns due to the presence of highly toxic chemicals such as benzene and toluene. The school has now begun upgrading the malfunctioning parts of the ventilation system. A Citizen's Committee on Indoor Air Quality has also formed to study the school's problems. Their recommendations include: that all school supplies come with a federal approved "less toxic" rating; ventilation system must be turned off when school buses are idling; and all trucks must shut off" their engines during deliveries.

U-32 Junior and Senior High School

During the 1992-93 school year, a number of students and staff at U-32 Junior and Senior High School complained of headaches, eye irritation and respiratory irritation while at school. The health complaints, which were reported while the school was under renovation, included an auto shop teacher who had an asthma attack in his classroom after using a solvent and a gym teacher who had an asthma attack shortly after the basketball court had been resurfaced with polyurethane.

Staff members detailed ten incidents of toxics in the ventilation system. The school hired Micro Assays to test air in the Fine Arts Department. Tests revealed the presence of nine volatile organic compounds including toluene, xylene, 1,2,4-trimethlybenzene, 1,2,4-trichlorobenzene, hexane, heptane, 3-methyl hexane and acetone.[31] These compounds are commonly found in gasoline, solvents, art supplies, cleaners, and science labs. It was also determined that the carpet was a probable source of pollutants contributing to health problems. After these reports were concluded, the school board began work to improve the air quality in the school. However, to date the school is still experiencing indoor air quality problems and is in violation of building safety codes.

Blue Mountain Union School

The staff at Blue Mountain Union School were surveyed during the 1993-94 school year for symptoms attributable to indoor air quality. 90% of the respondents reported headaches, eye, nose, throat and sinus irritation, drowsiness, confusion, difficulty concentrating and nausea.[32] Adverse health affects were reported to be worse in the afternoon, later in the week, and during fall and winter (periods when chemicals tend to accumulate in closed rooms). In 1994, Anderson Laboratories conducted a test of the school's air quality and found its air to be "seriously polluted."[33] These air quality tests found numerous products known to emit toxic fumes were in use throughout the school, including desk cleaner, new wall partitions, bathroom cleaners, unvented lamination machines, unvented copy machines and toxic ceiling tiles. Anderson Laboratories also reported the rooms of the 24-year old school were undervented because windows and air vents were sealed to conserve energy and reduce heating costs.

Anderson Laboratories recommended various means to improve the indoor air quality, including removing various sources of pollution and operating the ventilation system at all times while the school building is in use. The school followed the report's recommendations and discontinued the use of toxic cleaners, removed carpet from various locations, vented rooms where copy machines and laminating machines were located and reactivated the ventilation system. In addition, an air-handling machine was installed to improve ventilation. According to the business manager at Blue Mountain Union School, since the building was re-tested in 1996 there have been no findings of airborne toxics or reports of indoor air quality problems.[34]

RECOMMENDATIONS

No child, teacher or other member of the school community should be exposed to toxic chemicals in the school environment. Unfortunately, as this report shows, this simple, common sense declaration is not being adequately achieved in Vennont. Building materials and products routinely used in schools throughout the state contain toxic chemicals that pose a serious potential danger to children who are mandated by law to be there and to teachers and staff who must work there.

Ultimately, the solution to this problem lies in prevention: not using toxic chemicals in schools in the first place. As Harold Sargent, a former engineer at the Vermont Department of Health's Toxicology and Risk Assessment Program has said, "students in Vermont schools are `bombarded with chemicals' and removing the chemicals from people's everyday environment is a simple, cost-effective strategy that pays dividends."[35] Recommendations for state-level policies on how to move in this direction are presented below, along with actions individual schools can take in the short-term.

State-Level

Safe Materials Policy

The Department of Education in cooperation with the Department of Health and the Agency of Natural Resources should develop a Safe Materials Policy to reduce the use of toxics in schools. This policy should provide a set of criteria governing the selection of materials and products used in schools. Such a policy would dictate the use of non-toxic or least toxic school supplies and maintenance chemicals, Integrated Pest Management methods for pest control which reduce the use of pesticides and building materials which do not off gas toxics. Such a policy could be applied immediately for purchases of products used on an ongoing basis (such as school supplies and maintenance chemicals) and for all new construction and renovations. Existing carpets and toxic building materials could be replaced with non-toxic substitutes over time. Just like there are standards governing materials used in schools designed to prevent fires and other safety hazards, so too should there be standards to prevent toxic chemical exposures.

Ventilation Standards

There are currently no enforced ventilation standards for Vermont schools. The Department of Education in cooperation with the Department of Health should adopt and enforce an adequate ventilation standard for all Vermont schools. Such a standard should be at least 15 cubic feet of air per minute per person, as recommended by the American Society of Heating, Refrigeration and Air Conditioning Engineers. The ventilation standard should be required for all new and renovated schools and a schedule should be adopted to bring existing classrooms into compliance with the standard at the earliest possible time.

Identification of Non-Toxic Alternatives and Coordinated Purchasing

Even while the recommendations above are being debated, the Department of Education should develop information on non-toxic building materials and school supplies, and Integrated Pest Management services as well as assist local school districts by coordinating group purchasing to keep costs as low as possible.

Individual Schools

Environmental Health Coordinator

Each school should designate an Environmental Health Coordinator to monitor concerns and facilitate communication about indoor air quality and environmental health issues in the school. Teachers, staff and parents-as well as administrators-often don't know where to turn with questions about these issues and are frustrated by a lack of information and resources. The coordinator would be trained to recognize environmental health problems and act as an information resource for the school. A network of environmental health coordinators based in each school could share information and develop strategies to create a healthier school environment.

Toxics and Air Quality Audit

Each school should complete a toxics and air quality audit. Such an audit would evaluate building design and ventilation systems, and identify potential sources of environmental pollution in the school building including the use of pesticides and toxics in building materials and cleaning supplies. A basic building audit can be conducted by the environmental health coordinator and other school staff: The U.S. EPA's Tools for Schools program provides a good basis for conducting such an audit (Tools for Schools kits are available from VPIRG).

Reduce Use of Toxics

All schools can take immediate steps to reduce the use of toxics at little or no cost by substituting non-toxic alternatives for toxic maintenance chemicals, schools supplies and pesticides identified in a toxics and air quality audit.

Upgrade and Maintain Ventilation Systems

Schools should upgrade inadequate ventilation systems and perform regular maintenance to ensure that they are functioning properly.

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